November 14, 1968

M E M O R A N D U M

TO: Mr. John W. Warren
Director of Environmental Engineering

FROM: John C. Spindler

SUBJECT: Columbia Falls Plans for Final Pond

This is a review of plans of the Anaconda Aluminum Company to install a final pond system for sanitary and cooling water wastes at the Columbia Falls Plant. Considerable more information is needed before more concrete conclusions can be made, but some preliminary comments are possible.

During a short visit with Mr. Hook near the end of October, this year, some uncertainty was apparent concerning the degree of treatment provided by the Process Engineer's Incorporated, Oxidator-Digester in use at the Columbia Falls Plant. In general, primary sewage treatment provides 30-35 percent removal of biochemical oxygen demand (B.O.D.) and around 65% removal of suspended solids (S.S.). Secondary treatment calls for 85 plus percent removal of B.O.D. and S.S. Based on results of operations control tests reported by the Columbia Falls Plant Chemistry Department, the following reductions in B.O.D. and S.S. have been attained:

	Percentage Reduction	
July to July	B.O.D.	S.S.
1963 - 1964	96	93
1965 - 1966	94	88
1966 - 1967	91	78
1967 - 1968	93	89
Average	93.5	87.0

I'm quite certain that these results could be used to demonstrate that the facility provides secondary treatment.

Some question does remain concerning coliform reduction however, the following considerations may be pertinent. The Flathead River at Columbia Falls is classified as a "B-D1" water by the Montana Water Pollution Control Council. This classification allows 1,000 (fecal) coliform organisms per 100 milliliters (ml) of river water. I don't have flows for the Flathead at this point however, I shall assume that the seasonal low is somewhere in the area of 2,000 ft.^{3}/sec. Further, from the plans, it appears that waste flows from the plant total about 2.5 MGD. On this basis, the Flathead River at a low flow of 2,000 ft.^{3}/ second would provide a dilution factor of about 400 to the plant waste flow. This means then that the coliform level of the pond effluent could be as high as 400,000 coli/100 ml without violating the "B-D1" classification and, in turn the sewage treatment plant (STP) effluent to the pond could be as high as 12.4 x 10^6 coli/100 ml and raw sewage coli could exceed 80 x 10^6 per 100 ml. I doubt very much that even the total coli level of the raw sewage approachs 80 x 10^6/100 ml and, even if it does, I'm quite certain that we can safely assume a coliform reduction of 85 percent by the present facility (similar systems normally affect a 90-99% removal). Concluding this discussion of coliform reduction, I would suggest that any State Department of Health (or FWPCA) requirement for chlorination of the present STP effluent (and certainly a final pond effluent) is based more in an arbitrarily decreed aesthetic demand rather than in a real need based on actual coliform levels or water quality standards. Of course, it is necessary that we actually determine coliform levels in the waste and treated effluent to lend credence to this "common sense" speculation. To be certain, I stand ready to take issue with water pollution control authorities regarding the need for disinfection of the Columbia Falls Plant wastes, especially if a final pond is installed.

With regards to the need for a cooling system for the pot line water, again, a practical evaluation of existing conditions denies the necessity. We need information on the temperature and volume of cooling water from the plant but for demonstration purposes, I'll assume the temperature is 110°F and the quantity is 3 MGD (4.6 ft.^{3}/sec.). The D1 classification allows a rise of one-half (0.5°F) degree when receiving water temperature is above 67°F. Again, assuming a flow of 2,000 ft.^{3}/ second in the Flathead River, then the rise in river water temperature affected by the cooling water would be 0.1°F.

$$\frac{(4.6 \times 110) + (2,000 \times 67)}{4.6 + 2,000} = 67.1°F$$

Cooling water temperatures would have to exceed 285°F under these conditions to raise the temperature of the Flathead 0.5°F at 2,000 ft.^{3}/sec. flow. Even at a river flow of 1,000 ft.^{3}/sec., the cooling water temperature would have to exceed 145°F before the 0.5°F standard is violated. In any case, "common sense" dictum indicates that the need for a cooling system is questionable.

Calculations indicate that the daily organic loading discharged to the river from the present STP is about 15 lb. B.O.D. This quantity is most insignificant (0.02 ppm B.O.D. added to the river by the treated sewage). Again, on the basis of actual data, any additional treatment needed to meet the water quality standards is superfluous. This quantity of organic matter represents a loading on the proposed 2.64 A pond of about 6# B.O.D./A which is about 20-25 percent of the design criterion for sewage lagoons. Such B.O.D. may be decreased somewhat by the expected 1.5 day retention by the proposed pond (2.64 A x estimated average depth of 6 ft. = 15.8 A ft. x ($.3267 \times 10^6$ gal./A ft.) ÷ 3.3×10^6 gal./day waste flow to pond = about 1.5 days retention by proposed pond), however, any reduction during this short detention period is expected to be insignificant. Rather, some conversion of form of organics may take place in the pond, such as $NH_3 \rightarrow NO_2 \rightarrow NO_3 \rightarrow$ plant amino acids and proteins. Retention time isn't long enough to lead one to anticipate extensive "blooms" of planktonic algae, however, the pond environment should be ideal for the development of attached algae (such as Cladophora), duck weed (Lemnae), and rooted aquatic plants, all of which can create maintenance problems and nuisance odors. Further (and again we need information on evaporation rates and climatological data in the Columbia Falls area), I would expect but little cooling by such a small pond during the most critical period when air and cooling water temperatures are the highest and stream flow is at a summer minimum.

Mr. Hook stated that he wished to plant trout in the pond and maintain it as a fishery with the possibility of interesting some University of Montana professors in some sort of limnological study. I have expressed my opinion of the latter situation in my "Sense and Nonsense" Memo dated October 24, 1968 and I stated to Mr. Hook during our short visit that I have serious doubts that the pond would be a suitable environment for trout. Of course, if the cooling water in the summer time is less than 70-80°F, then a trout population could possibly be maintained within the limits of disease probabilities. Even at temperatures between 60 and 70°F, trout are most difficult to maintain disease-free.

Two points should be taken into consideration, viz., morphology and location of the pond. The "frying-pan" shape (with a crooked handle) of the pond, especially with the shallow inlet portion violates any and all sewage lagoon design criteria. I would anticipate some reluctance on the part of the State Department of Health to approve such a design, even as a tertiary sewage treatment pond. Finally, although I haven't seen the pond site, it appears to be well within the flood-water level of the Flathead River, thus prone to damage during extra-high runoff years and again, subject to disapproval by State Department of Health reviewing engineers.

As stated earlier, the following information is needed to further evaluate the proposed pond:

1. Coliform levels.
2. River flows.
3. Climatological data and/or expected evaporation rate.

To be sure, a final pond would be an asset for retaining any plant losses not assimilable by existing treatment facilities. It is suggested however, that further study of such a development may be in order.

Mr. Hook also expressed some anxiety in connection with occasional oil losses from the plant. Again, we need information on the type and potential quantity of oil involved, however, depending upon these factors, the present treatment facility may handle nominal losses and if not, the possibility of installing a baffled sump or an A.P.I. (American Petroleum Institute) oil separator may have to be considered.

About the only positive items noted during review of the plans concerns the two septic tank systems shown on plan sheet U-31A. Inverts and gradients aren't shown however, it appears that the sanitary fixture served by these two septic tanks could be connected to the sanitary sewerage system with not too much capital expenditure.

This preliminary treatise of the proposed pond is admittedly based in considerable speculation but is presented as a practical approach to the proposal and hopefully has brought out some considerations which may need more study.

Respectfully submitted,

John C. Spindler